EXPLANATORY STATEMENT

Issued by the Authority of the Minster for the Environment

Carbon Credits (Carbon Farming Initiative) Act 2011

Carbon Credits (Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings—FullCAM) Methodology Determination 2014

Background

The *Carbon Credits (Carbon Farming Initiative) Act 2011* (the Act) enables the crediting of greenhouse gas abatement in the land sector. Greenhouse gas abatement is achieved by either reducing or avoiding emissions or by removing carbon from the atmosphere and storing it in soil or trees.

Abatement activities are undertaken as offsets projects. The process involved in establishing an offsets project is set out in Part 3 of the Act. An offsets project must be covered by, and undertaken in accordance with, a methodology determination.

Subsection 106(1) of the Act empowers the Minister to make, by legislative instrument, a determination known as a methodology determination. The purpose of a methodology determination is to establish procedures for estimating abatement (emissions reductions and sequestration) and project rules for monitoring, record keeping and reporting on abatement.

A methodology determination must meet the offsets integrity standards set out in section 133 of the Act and the other eligibility criteria set out in section 106 of the Act. The Minister cannot make a methodology determination unless the Domestic Offsets Integrity Committee (the DOIC) has endorsed the proposal for the methodology determination under section 112 of the Act and advised the Minister of the endorsement under section 113 of the Act. The DOIC is an independent expert panel established to evaluate proposals for methodology determinations.

Application of the Determination

The *Carbon Credits (Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings—FullCAM) Methodology Determination 2014* (the Determination) sets out the detailed rules for implementing and monitoring an offsets project under the Carbon Farming Initiative (CFI). The Determination applies to projects which sequester carbon by establishing and maintaining trees in any part of Australia where they have the potential to attain a height of at least 2 metres, and a crown cover of at least 20%, on land that has previously been used for certain agricultural purposes (grazing or cropping).

The Determination provides for the calculation of the net abatement of greenhouse gases for a project during a reporting period by estimating the carbon dioxide stored in the biomass of project trees, litter and fallen dead wood, known as 'project forest biomass'. Any carbon dioxide removed from the atmosphere and stored as carbon within project forest biomass at the time the project commences, and emissions of carbon dioxide, methane or nitrous oxide from fossil fuel use and fire events during the reporting period, are then subtracted from the project abatement.

The Determination differs from the similar *Carbon Credits (Carbon Farming Initiative) (Methodology for quantifying carbon sequestration by permanent environment plantings of native species using the CFI Reforestation Modelling Tool) Methodology Determination 2011* and the *Carbon Credits (Carbon Farming Initiative) (Methodology for quantifying carbon sequestration by permanent plantings of native mallee eucalypt species using the CFI Reforestation Modelling Tool) Methodology Determination 2012* by:

- Using the Full Carbon Accounting Model (FullCAM) to estimate biomass of project trees and debris and growth calibrations which are not available in the Reforestation Modelling Tool.
- Providing options to collect remote or on-ground data and estimate biomass using specific calibrations.
- Refining the stratification and sampling requirements while maintaining consistency with the *Carbon Farming Initiative Sampling Guidelines* and the *CFI Mapping Guidelines*.

A project proponent wishing to implement the Determination must make an application to the Clean Energy Regulator (the Regulator) and meet the eligibility requirements for an offsets project set out in subsection 27(4) of the Act. These requirements include compliance with the rules set out in the Determination. It is also possible for existing approved projects to apply to move to a new methodology determination under section 128 of the Act where their project is covered by that new determination.

Offsets projects that are undertaken in accordance with the Determination and approved by the Regulator can generate Australian carbon credit units (ACCUs) that can be sold into relevant markets in order to generate a source of revenue for the project proponent.

Public consultation

On 18 October 2013 the Department of the Environment submitted a methodology proposal for the DOIC's consideration.

At its 24 October 2013 meeting the DOIC agreed to release the methodology for public consultation, pending some minor amendments. The methodology was released for public consultation on 28 November 2013 and the consultation period closed on 7 January 2014.

On 13 March 2014 Version 0.36 of the methodology proposal was endorsed by the DOIC.

Determination details

The Determination is a legislative instrument within the meaning of the *Legislative Instruments Act 2003*.

The Determination commences the day after it is registered on the Federal Register of Legislative Instruments.

Details of the Determination are at Attachment A.

A Statement of Compatibility prepared in accordance with the *Human Rights (Parliamentary Scrutiny) Act 2011* is at Attachment B.

Attachment A

Details of the Determination

Documents incorporated by reference

The Determination incorporates a number of documents by reference as provided under subsection 106(8) of the Act. A description of these documents and their function under the Determination is provided below.

CFI Mapping Guidelines

The *CFI Mapping Guidelines* are designed to complement rules and regulations contained within the *Carbon Credits (Carbon Farming Initiative) Act 2011* (the Act), the *Carbon Credits (Carbon Farming Initiative) Regulations 2011* (the Regulations) and a number of the associated methodology determinations. The *CFI Mapping Guidelines* guide project proponents on how to prepare geospatial mapping for the purposes of:

- meeting scheme compliance obligations;
- providing information to the Clean Energy Regulator (the Regulator);
- defining the project area and strata; and
- estimating abatement.

These guidelines may be reviewed and updated as necessary and are currently published on the Department's website at: http://www.climatechange.gov.au/reducing-carbon/carbon-farming-initiative/methodologies/spatial-mapping-guidelines.

Guidance for using the Full Carbon Accounting Model in Carbon Farming Initiative Methodologies (FullCAM Guidelines)

The FullCAM Guidelines have been developed by the Department to assist project proponents to correctly use FullCAM when undertaking a CFI project under a number of methodology determinations.

The FullCAM Guidelines provide:

- an overview of FullCAM; and
- a step-by-step guide for using FullCAM that is consistent with the requirements of each of the CFI methodology determination s that utilise FullCAM.

FullCAM must be used to model carbon stock change and emissions for certain specified carbon pools under this Methodology Determination. The FullCAM Guidelines may be reviewed and updated as necessary and are published on the Department's website at: http://www.climatechange.gov.au/reducing-carbon/carbon-farming-initiative/methodologies/methodology-determinations/FullCAM.

Part 1 Preliminary

Part 1 sets out the name of the Determination, which is the *Carbon Credits (Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings—FullCAM) Methodology Determination 2014* ***[Section 1.1]***.

The Determination commences on the day after it is registered on the Federal Register of Legislative Instruments and expires the day before it would otherwise be repealed under subsection 50(1) of the *Legislative Instruments Act 2003* ***[Section 1.2]***.

While the Determination may apply to projects that were established prior to the commencement date, the project proponent can earn credits only for abatement which occurs from commencement date. Subsection 27(15) of the Act prevents the crediting of abatement before this date.

Key terms used in the Determination are defined as follows ***[Section 1.3]*****:**

- 'adjacent tree' which refers to a non-project tree that:
    a) has a stem in an adjoining area; and
    b) has a crown that extends 3 metres or more across at its widest point, at the time of FullCAM modelling.
- 'adjoining area' which refers to the area that extends outwards for 20 metres perpendicular to the long axis of each side of a narrow or wide linear planting as measured from the outer stems of the planting.
- 'belt planting' which refers to a planting that:
    a) is established in a belt configuration;
    b) can follow contours or be arranged in a straight line; and
    c) is either a narrow or wide linear planting.
- 'block planting' which refers to a planting that:
    a) is not a:
        (i) narrow linear planting; or
        (ii) wide linear planting; and
    b) does not consist of a single row.
- 'domain group' which refers to the set of attributes of plantings, i.e. types; geometries, spacing and—if relevant—the stocking density and tree proportion, for which a calibration is applicable.
- 'forest cover'—land has forest cover if the vegetation on the land includes trees that:
    a) are 2 metres or more in height; and
    b) provide crown cover of at least 20% of the land.
- 'forest potential'—land has forest potential if:
    a) the land has an area of at least 0.2 of a hectare; and
    b) the vegetation on the land includes trees that have the potential:
        (i) to reach 2 metres or more in height; and
        (ii) to provide crown cover of at least 20% of the land.

- 'FullCAM' which refers to the latest version of the Full Carbon Accounting Model - released publicly on the Department's website.
- 'generic calibration' which refers to the 'mixed-species environmental planting' calibration and settings used in FullCAM.
- 'intended plot location' which refers to the spatial coordinates for a randomly selected grid intersect from a GIS overlay used to define the proposed location of plots.
- 'land management regime' which refers to a set of actions including:

    a) preparation prior to planting;

    b) planting;

    c) thinning;

    d) weed control treatment; and

    e) the application of fertiliser;

    which are applied in a uniform or consistent manner to an area of land
- 'mallee' which refers to any of the Australian species of the genus *Eucalyptus* that generally exhibit a growth form of multiple stems arising from a large underground lignotuber. Eucalyptus species recognised as having the form of a mallee include: *E.horistes, E.calycogona, E.cneorifolia* [Kangaroo Island CS20275]*, E.cyanophylla,* [Loxton cult.]*, E.dumosa, E.gracilis* [Loxton cult.]*, E.incrassata, E.kochii, E.kochii ssp. borealis, E.kochii ssp. plenissima, E.leptophylla, E.loxophleba ssp. lissophloia, E.oleosa, E.plenissima, E.polybractea, E.porosa, E.socialis*.
- 'management event' which refers to a land management activity that can be modelled in FullCAM, such as a planting, thinning, harvest, or fire.
- 'modelling commencement' which refers to the commencement date of modelling forest growth using FullCAM, and is the planting date for each carbon estimation area.
- 'native vegetation' which refers to vegetation:

    a) consisting of species native to the local area; and

    b) with a mix of trees, shrubs, and understorey species that reflects the structure and composition of the local native vegetation community.

    Note that a monoculture may constitute native vegetation where it can naturally occur within the local vegetation community.
- 'planting date' which refers to the date on which planting last occurred within a carbon estimation area as demonstrated to the satisfaction of the Regulator.
- 'planting geometry' which refers to one of the following:

    a) narrow linear planting;

    b) wide linear planting; or

    c) block planting.
- 'planting spacing' which refers to the spatial configuration of a planting type and is one of the components that defines a domain group.

- 'planting type' which refers to one of the components that defines a domain group and means one of the following:
    a) a mallee planting;
    b) a mallee planting consisting of specified mallee species; or
    c) a mixed species environmental planting.
- 'plot' which refers to a defined area of land within a carbon estimation area where on-ground sampling or image analysis is undertaken.
- 'probable limits of error' which refers to a measure of precision calculated in accordance with Equations 4 and 9.
- 'random planting' which refers to a planting not planted in rows.
- 'shrub' which refers to a perennial plant that has primary supporting structures consisting of secondary xylem and that does not have, or have the potential for its stem diameter to be measured at breast height (DBH), where DBH is defined as 130 centimetres in height.
- 'specific calibration' which refers to a calibration used in FullCAM specified in Schedule 1 of the Determination.
- 'stem' which refers to the ascending axis of a plant and the main structural component of the above-ground portion of trees and shrubs.

    Note that multi-stemmed trees or shrubs are treated as a single plant for estimating stocking density.
- 'stocking density' which refers to the number of live individual trees or shrubs per hectare in a carbon estimation area and/or the number of live individual seedlings or seeds per hectare at establishment.
- 'stratification' which refers to the division of the project area into one or more carbon estimation areas and, if required, exclusion areas.
- 'tree proportion' which refers to the proportion of individual live trees relative to the total of individual live trees and shrubs in a mixed-species environmental planting.

Some terms that are not defined in the Determination have the meaning given by section 5 of the Act. The Act is available at www.comlaw.gov.au

Note Under section 23 of the *Acts Interpretation Act 1901*, words in the Determination in the singular number include the plural and words in the plural number include the singular.

The kind of project to which the Determination applies

The effect of paragraph 106(1)(a) of the Act is that a methodology determination must specify the kind of offsets project to which it applies.

The kind of offsets projects to which the Determination applies is specified in section 1.4. These kinds of projects are 'specified' offsets projects as follows:

- the establishment of a permanent planting on or after 1 July 2007; or
- a forestry project accredited under the Commonwealth Government's Greenhouse Friendly™ initiative;
- a permanent planting accredited under:

  - the New South Wales Government's Greenhouse Gas Reduction Scheme; or
  - the Australian Capital Territory Government's Greenhouse Gas Abatement Scheme; or
- a permanent planting established before 1 July 2007 for which there is documentary evidence of a kind mentioned in subregulation 3.28(3) of the Regulations that demonstrates, to the satisfaction of the Regulator, that the primary purpose of the planting was generation of carbon offsets.

When demonstrating that the primary purpose of the planting was generation of carbon offsets, the documentary evidence ***[Section 1.4]*** may include the contracts for the sale of offsets and must:

- be dated no later than 2 years after the date the plantings were established;
- show that the carbon rights had been registered for the plantings; and
- include a statutory declaration that the plantings were entirely privately-funded.

Part 2 Requirements for declaration as eligible project

Eligible projects

The effect of paragraph 106(1)(b) of the Act is that a methodology determination must set out requirements that must be met before a project can be an eligible offsets project.

To be declared an eligible offsets project, a project to which the Determination applies must meet the requirements specified in Part 2 of the Determination. These requirements are in addition to those set out in the Act and Regulations for applications for a declaration of an eligible offsets project ***[Section 2.1]***.

Project mechanism

The determination prescribes the project mechanism of an eligible offsets project under the Determination. The project mechanism is the means by which abatement is generated.

The project must establish and maintain a permanent planting of trees which is one of the following:

- a mixed-species environmental planting; or
- a mallee eucalypt planting.

Land on which project mechanism is implemented

There are specific requirements that must be met for land in the project area where project activities will occur and project abatement estimated. Areas of land which do not have project land characteristics, such as roads, water courses and large rock outcrops, are not counted when abatement is calculated ***[Section 2.3]***.

The project area must be located in Australia but excludes Australia's external territories (such as Christmas Island and Norfolk Island) as FullCAM does not provide data on these areas.

Under the Determination, the project area must include land that has been used predominantly for grazing or cropping, and/or was fallow between those activities, for at least 5 years before project commencement. The term 'project commencement' means the earliest date for which there is documentary evidence that demonstrates, to the satisfaction of the Regulator, that planting has occurred in the project area.

There are specified requirements for trees that will be planted within the project area. These trees are referred to in the Determination as 'project trees'. Regardless of species, project trees must have the potential to grow at least 2 metres tall and to cover with their crowns at least 20% of the area of the stratum in which they are located.

The potential of the project trees to achieve forest cover can be demonstrated by reference to the growth characteristics of the species to which the project trees belong and the planting density.

Table 1 shows an estimate of the minimum number of trees per hectare to achieve 20% crown cover in a stand of trees.

Table 1 – Guidance on the ratio of trees to crown cover for a given crown diameter

Mature crown diameter per tree (m)	Crown area per tree at maturity (m^2)	Crown area per tree at maturity (ha)	Minimum number of trees per hectare required for 20% crown cover (trees/ha) (Crown cover of 20% (i.e. 0.2ha) divided by crown area per tree at maturity)
5.0	19.63	0.00196	102
4.5	15.90	0.00159	126
4.0	12.57	0.00126	159
3.5	9.62	0.00096	208
3.0	7.07	0.00071	283
2.5	4.91	0.00049	407
2.0	3.14	0.00031	637

Crown cover as a proportion can be estimated by multiplying planting density (trees per hectare) by crown area (in hectares). For example, a minimum density to achieve 20% crown cover with evenly distributed trees for a species with a crown diameter of 3.5 to 4 metres and a circular crown is about 150–200 trees per hectare.

Project proponents are encouraged to plant in each stratum more than the minimum number of trees required to achieve greater than 20% crown cover, to allow a buffer for tree mortality.

Mallee plantings—600 mm long-term average annual rainfall

There is a rainfall restriction on land on which a mallee planting occurs. This is to address the risk that modelling may over estimate the carbon stock in a mallee planting in a higher rainfall area, given that mallee species are generally adapted to lower rainfall areas. The land must receive 600mm long-term average rainfall or less, as defined by the long term average rainfall map layer in the CFI Mapping Tool.

However if the mallee planting satisfies the requirements for a specific calibration that is used to estimate the carbon stocks for the planting, then the 600 millimetres long-term average rainfall restriction does not apply to the planting. This is because the geographic limits that apply to mallee specific calibrations under FullCAM serve a similar function as the 600mm rainfall restriction.

Identification of project area

Under the Act, the boundaries of the project area must be delineated in accordance with the CFI Mapping Guidelines ***[Section 2.4]***.

Under the CFI, project proponents of carbon sequestration projects can include their whole land title as their project area, even if the project is only being undertaken on a part of that land.

The boundaries of the project area of a project to which the Determination applies must be determined in accordance with the CFI Mapping Guidelines.

Part 3 Project Operation

Division 3.1 Operation of eligible projects

Operation of eligible projects

Under the Determination, a number of conditions or requirements must be satisfied when undertaking the project to ensure the correct calculation of carbon abatement. These ongoing operational requirements are specified in the following Divisions ***[Section 3.1]***.

Division 3.2 Stratification of the project area

Initial stratification of project area

Before submitting the first offsets report for the project, the project proponent must stratify the project area in accordance with this Division ***[Section 2.4]***.

Requirements for a carbon estimation area

A carbon estimation area (CEA) must consist of land on which the project mechanism is implemented. A CEA must be mapped in accordance with the CFI Mapping Guidelines ***[Section 2.4]***.

Uniformity requirements

A carbon estimation area must have uniform site characteristics in relation to the following:

- soil type;
- aspect; and
- slope position;

It must also be planted with the same combination of plant species across the area and be established and managed under the same land management regime. The land management regime consists of activities relevant to modelling using FullCAM, including:

- preparation activities prior to planting;
- planting;
- thinning;
- weed control; and
- the application of fertiliser.

Note that for the purpose of stratification, stratify carbon estimation areas at distances below the 250 metre FullCAM grid size will not yield any improvement in modelling accuracy.

For a carbon estimation area comprised of a set of polygons the applicable radius specified in CFI Mapping Guidelines is taken to be:

- 1.5 kilometres for a mixed species environmental planting; and
- 5 kilometres for a mallee planting.

Carbon estimation area boundaries

This section sets out requirements for the boundaries of carbon estimation areas.

The boundaries of each carbon estimation area must be defined in accordance with the CFI Mapping Guidelines using at least one of the following:

- field surveys;

- aerial photographs;
- date-stamped, geo-referenced remotely-sensed imagery, including indicators of vegetation cover vegetation cover data;
- soil, vegetation or landform maps.

In this section the term 'indicators of vegetation cover' means satellite or aerial imagery that has been processed to show vegetation cover or other relevant vegetation attributes.

If the plantings in a carbon estimation area are established in rows, the boundary parallel to the longest axis of the planting must be one metre from the outer row of stems ***[Section 3.4]***. Section 3.5 specifies the maximum permitted width for certain carbon estimation areas.

In addition, the boundary parallel to the shortest axis of the planting must be one metre from the outer stems of the plants at the end of the rows. The boundary surrounding an exclusion area within a carbon estimation area must be one metre from the stems bordering the exclusion area boundary ***[Section 3.4]***.

If the plantings in a carbon estimation area are not established in rows then the outer boundary of the carbon estimation area is immediately outside the stems of the outermost plants and the boundary surrounding any exclusion area within a carbon estimation area is immediately outside the stems of the plants bordering the exclusion area.

If the plantings in a carbon estimation area are established in any planting geometry that is not consistent with a narrow or wide-linear planting and the boundary of the carbon estimation area was defined in accordance with another CFI methodology determination for which an offsets report has been submitted and accepted by the Regulator then, subject to still meeting the requirements of section 3.3 and 3.8, the existing carbon estimation area boundary may be used. In other words, if the area was established according to another methodology determination and was accepted by the Regulator, and the existing boundaries also meet the requirements of stratification in section 3.3, then the existing boundaries may used for the current determination. This is intended to allow for previously defined carbon estimation areas that are otherwise consistent with the requirements of this methodology determination except that they may a boundary that exceeds the 1 metre requirement because previous methodology determinations did not include this requirement.

Note that if the existing carbon estimation area has to be re-stratified, it must be done so according to the requirements in section 3.8, not the requirements in the previous methodology determination.

The preceding conditions in this section establish an unbiased means of delineating the boundary for the calculation of the area of the carbon estimation area. The area is a critical parameter for accurate estimation of carbon abatement in a carbon estimation area.

The boundaries of carbon estimation areas must be identified before submitting the next offsets report to the Regulator. Note that the next offsets report could be the first offsets report to be submitted for the project.

Maximum permitted carbon estimation area width

The maximum permitted width for carbon estimation areas containing belt plantings planted in rows is specified in Schedule 2 of the Determination. The width restrictions in Schedule 2 ensure the belts are treated correctly as single carbon estimation areas in accordance with the CFI Mapping Guidelines and that the relevant calibrations used for modelling with FullCAM are valid for the width of the belts ***[Section 3.5]***.

Carbon estimation area planting requirements

A carbon estimation area must contain either ***[Section 3.6]***:

- a mixed-species environmental planting; or
- a mallee planting.

Only one calibration may be applied to a carbon estimation area in a reporting period.

The planting in the carbon estimation area must have the potential to achieve forest cover no later than 12 months after the planting date.

Requirements for an exclusion area

Land in the project area on which the project mechanism is not implemented must be defined and mapped as an exclusion area in accordance with the CFI Mapping Guidelines ***[Section 3.7]***.

Re-stratification of a carbon estimation area

A carbon estimation area may be re-stratified only as provided in Division 3.2 ***[Section 3.8]***.

A carbon estimation area must be re-stratified if one or more of the following occurs:

- the site characteristics in the area are no longer uniform;
- the land management regime ceases to be uniform across the area;
- parts of a planting within the area fail to achieve forest potential;
- a disturbance event kills 5% or more trees in the area;
- a management event such as weed control or fertiliser application is undertaken in a non uniform manner in an area that applies a generic calibration;
- a different calibration is to be applied to part of an existing carbon estimation area—in which case the existing carbon estimation area may be re-stratified according to where the different calibrations are to be applied.

If a carbon estimation area is re-stratified, the new boundaries must be identified in the next offsets report that is submitted to the Regulator.

If the project mechanism is to be carried out in an area previously defined as an exclusion area, the area may be re-stratified as a carbon estimation area.

Division 3.3 Domain group—planting type and requirements

Divisions 3.3 to 3.5 define the domain group for a particular calibration. The domain group is the set of requirements for:

- planting type;
- planting geometry;
- planting spacing; and
- if relevant, stocking density and tree proportion;

that taken together restrict the circumstances where a particular calibration may be applied.

An additional restriction on the use of a specific calibration may arise due to competition from adjacent trees as determined in Division 3.7.

A further restriction on the application of a specific calibration occurs within FullCAM which intentionally limits the availability of a specific calibration for modelling purposes to within the geographical area for which the specific calibration has been validated.

Section 4.9 creates limited exceptions to the requirement to satisfy the domain group conditions.

Mallee plantings

A mallee planting is a planting that consists of mallee species regardless of whether the planting meets the requirements for a domain group for a specific calibration ***[Section 3.9]***.

A mallee planting that is intended to be eligible for the application of a specific calibration must consist of a planting that satisfies the requirements for one of the domain groups of specified mallee species.

In this section:

specified mallee species means a single species planting of one of the following:

- *Eucalyptus loxophleba* ssp. *lissophloia* L.A.S. Johnson and K.D. Hill (smooth bark York gum); or
- *Eucalyptus polybractea* R.T. Baker (blue mallee); or
- *Eucalyptus kochii* sub-species comprising:
    - *E. kochii*, Maiden and Blakely; and/or
    - *E. kochii* ssp. *borealis* C.A. Gardner; and/or
    - *E. kochii* ssp. *plenissima* C.A. Gardner.

To avoid doubt, a mallee planting that does not meet the specified requirements is not eligible for the application of a specific calibration.

Mixed-species environmental plantings

A mixed-species environmental planting must consist of a mixture of tree and shrub species that ***[Section 3.10]***:

a. are native to the local area of the planting;

b. are sourced from seeds (i.e. not natural regeneration):

c. from within the natural distribution of the species; and

d. that are appropriate to the biophysical characteristics of the area of the planting;

e. may be a mix of trees, shrubs, and understorey species where the mix reflects the structure and composition of the local native vegetation community; and

f. are established through the planting of tube-stock or direct seeding.

A mixed-species environmental planting that is intended to be eligible for the application of a specific calibration must consist of a planting that satisfies the requirements for one of the following domain groups:

a. Mixed-species environmental planting—tropical; or

b. Mixed-species environmental planting—temperate.

To avoid doubt, a mixed-species environmental planting that does not meet the specified requirements is not eligible for the application of a specific calibration.

Division 3.4 Domain group—planting geometry and spacing

Narrow linear plantings

For a mallee planting, a narrow linear planting must consist of 2 rows of trees planted from tube-stock or direct seeding and also meets the spacing requirements set out in section 3.14 ***[Section 3.11]***.

For a mixed-species environmental planting, a narrow linear planting must be established in rows using tube-stock or direct seeding; or randomly using tube-stock or broadcast seeding, or both. The planting must also meet the spacing requirements of section 3.15.

Wide linear plantings

For a mallee planting, a wide linear planting must consist of a belt planting of at least 3 and no more than 8 rows of trees planted from tube-stock or direct seeding; and that also meets the requirements of section 3.14 ***[Section 3.12]***;

For a mixed-species environmental planting, a wide linear planting must be established in rows using tube-stock or direct seeding; or randomly using tube-stock or broadcast seeding, or both. The planting must also meet the spacing requirements of section 3.16.

Block planting

A block planting is any planting that does not meet the requirements of a ***[Section 3.13]***:

a. narrow linear planting; or

b. wide linear planting;

and which:

c. meets the requirements specified in section 3.17; and

d. does not consist of a single row.

Mallee plantings—spacing

This section specifies the spatial configuration of a narrow or wide linear planting in a mallee planting ***[Section 3.14]***.

The average distance between the rows in the planting must be no greater than 4 metres.

The distance between the stems of the trees in the outermost rows in the planting must be at least 40 metres from the stems of any adjacent planting in the project area.

Mixed-species environmental plantings—narrow linear planting spacing

This section specifies the spatial configuration of a narrow linear planting in a mixed-species environmental planting ***[Section 3.15]***.

For random plantings the distance between the stems of the outermost trees or shrubs must be less than or equal to 20 metres. This distance is measured from the outermost edge of the stems of the plants to the other outermost edge of the stems.

For other plantings the distance between the outermost rows must be less than or equal to 20 metres. This distance is measured from the outermost edge of the stems of the plants to the other outermost edge of the stems.

The distance between the stems of trees or shrubs at the outermost edge of the planting must be at least 40 metres from the stems of another planting in the project area.

The planting must not be affected by material competition from adjacent trees as determined by applying the processes specified in Division 3.7.

Mixed-species environmental plantings—wide linear planting spacing

This section specifies the spatial configuration of a wide linear planting in a mixed species environmental planting ***[Section 3.16]***.

For random plantings the distance between the stems of the outermost trees or shrubs must be greater than 20 metres and less than 40 metres.

For other plantings the distance between the outermost rows must be greater than 20 metres and less than 40 metres.

The distance between the stems of trees or shrubs at the outermost edge of the planting must be at least 40 metres from the stems of another planting in the project area.

Block planting—spacing

The spacing between block plantings must be in accordance with the CFI Mapping Guidelines ***[Section 3.17]***.

Under the Determination, there are no specific requirements for the spacing of block plantings other than the rules applicable to carbon estimation areas and exclusion areas provided in the CFI Mapping Guidelines.

Division 3.5 Domain group—stocking density and tree proportion

Subdivision 3.5.1 Stocking density and tree proportion—default values

Propagated seedling stock—default values

If a carbon estimation area is established using propagated seedling stock (or tube-stock) the following requirements apply as default settings ***[Section 3.18]***:

For the first 5 years following the planting date the planting is taken to have a stocking density of 85 % of the number of tube-stock planted per hectare for the carbon estimation area; and the tree proportion is taken to be the same as the proportion of trees to shrubs for the tube-stock at the date of planting.

This reflects an assumption that the planting has achieved the industry average of 85% survival of planted tube-stock.

More than 5 years after the planting date the stocking density is taken to be less than 500 stems per hectare; and if the planting includes a mix of tree and shrubs, the tree proportion is taken to be less than 75%.

Direct seeding —default values

If a carbon estimation area is established using direct seeding the following requirements apply as default settings ***[Section 3.19]***:

The stocking density is taken to be less than 500 stems per hectare; and if the seed planted:

a. consisted of tree species only—the tree proportion is taken to be greater than 75%; or

b. consisted of a mix of tree and shrub species—the tree proportion is taken to be less than 75%.

Alternatives to default values

After 2 years from the planting date, a project proponent may choose to measure stocking density and tree proportion to ascertain measured values for specific carbon estimation areas in accordance with Subdivision 3.5.2 ***[Section 3.20]***.

Subdivision 3.5.2 Stocking density and tree proportion sampling requirements

Requirements for a specific calibration

For the purposes of section 4.8, to be eligible to use a specific calibration for which a stocking density and/or tree proportion is defined in Schedule 1, a project proponent may be required to measure the stocking density and/or tree proportion in accordance with this Subdivision ***[Section 3.21]***. Typically, a proponent may seek to measure stocking density or tree proportion after 5 years from the planting date. This is because after this time, the default stocking density and tree proportion values may not satisfy the domain group requirements for the relevant specific calibration. Alternatively, the proponent may be seeking to apply a different specific calibration that requires evidence of the current stocking density or tree proportion.

If an event occurs that may change the stocking density and/or tree proportion such that the requirements for a specific calibration may no longer be met, then for the project proponent must remeasure the stocking density and/or tree proportion in accordance with section 3.20 and this Subdivision.

"No sampling" requirement for a specific calibration

If it is specified in Schedule 1 that no sampling is required for a specific calibration then for that specific calibration a project proponent is not required to undertake the processes in section 3.18 or 3.19; and the evidence requirements in section 3.22 do not apply.

Evidence of stocking density and tree proportion

If requested by the Regulator, a project proponent must provide evidence that a planting in a carbon estimation area meets or exceeds the default stocking density or tree proportion, or both ***[Section 3.22]***.

Estimating stocking density

There are two options for estimating the stocking density for a carbon estimation area: A proponent can either ***[Section 3.23]***:

a. count every tree and shrub, and divide by the area of the carbon estimation area; or

b. undertake systematic random sampling.

Note that for reasons of efficiency, it is likely that the method applied to estimate stocking density under this section would be of the same kind as that used to estimate tree proportion under section 3.26.

If systematic random sampling is used to estimate stocking density, intended plot locations must be selected in accordance with section 3.27.

The estimation of the stocking density for a carbon estimation area may be by:

a. on-ground measurement; or

b. using date-stamped, geo-referenced, remotely-sensed imagery.

If a project proponent elects to estimate stocking density by on-ground measurement then:

a. plots must be established within the carbon estimation area at intended plot locations;

b. each living tree and shrub in the plot must be counted; and

c. the stocking density for the carbon estimation area must be calculated using the calculations specified in Subdivision 3.6.1.

If a project proponent elects to estimate stocking density using date-stamped, geo-referenced, remotely-sensed imagery then:

a. the imagery must have:

   i. a horizontal accuracy in accordance with the CFI Mapping Guidelines; and

   ii. a pixel resolution of 2.5 metres or better so that individual trees can be differentiated; and

   iii. plots established at each intended plot location;

Once suitable imagery is available, each living tree and shrub in the plot must be counted; and the stocking density for the carbon estimation area must be calculated as specified in Subdivision 3.6.1.

Estimating tree proportion

There are two options for estimating the tree proportion for a carbon estimation area. A project proponent may choose to estimate the tree proportion by ***[Section 3.24]***:

a. counting every tree and shrub, and calculating the ratio of the tree counts to the total count; or

b. systematic random sampling.

As identified above, for reasons of efficiency, it is likely that the method applied to estimate tree proportion under this section would be the same kind as that used to estimate stocking density under section 3.23.

If systematic random sampling is used to estimate tree proportion, intended plot locations must be selected in accordance with section 3.27.

If being used, the method for estimating tree proportion for a carbon estimation area must be estimated by on-ground measurement.

To estimate tree proportion by on-ground measurement:

a. plots must be established within the carbon estimation area at intended plot locations;

b. each living tree and shrub in the plot must be counted; and

c. the tree proportion for the carbon estimation area must be calculated as specified in Subdivision 3.6.2.

Number of plots and probable limits of error

If a project proponent undertakes sampling on-ground or using date-stamped, geo-referenced, remotely-sensed imagery to estimate tree proportion and/or stocking density in a carbon estimation area, the project proponent must establish and analyse a minimum of 10 plots in each carbon estimation area ***[Section 3.25]***.

The project proponent must establish and analyse an additional number of plots estimated to achieve a target probable limits of error at the P=0.05 level.

Determining values for stocking density and tree proportion

The values for stocking density and tree proportion are determined based on the calculation of the probable limits of error for each parameter ***[Section 3.26]***.

For stocking density

If the probable limits of error for stocking density at the specified level of significance (P=0.05) are calculated to be:

a. equal to or less than 10%—then the stocking density for the carbon estimation area may be taken to be equal to the mean as calculated by Equation 2 in section 3.33;

b. greater than 10% and equal to or less than 50%—then the stocking density for the carbon estimation area may be taken to be equal to the lower confidence limit as calculated by Equation 5 in section 3.36; or

c. greater than 50%—then the proponent must choose to either:

    i. repeat the sampling process with an additional grid overly as specified in section 3.27; or

    ii. use the applicable default stocking density for the planting as specified in section 3.18 or 3.19.

For tree proportion

If the probable limits of error for tree proportion at the specified level of significance (P=0.05) are calculated to be:

a. equal to or less than 10%—then the tree proportion for the carbon estimation area may be taken to be equal to the mean as calculated by Equation 7 in section 3.38;

b. greater than 10% and equal to or less than 50%—then the tree proportion for the carbon estimation area may be taken to be equal to the lower confidence limit as calculated by Equation 10 in section 3.41; or

c. greater than 50%—then the proponent must choose to either:

    i. repeat the sampling process with an additional grid overly as specified in section 3.27; or

    ii. use the applicable default tree proportion for the planting as specified in section 3.18 or section 3.19.

Establishing a grid overlay

If a project proponent undertakes sampling in accordance with section 3.23 or 3.24, a grid overlay must be established in accordance with the following requirements ***[Section 3.27]***:

The grid must consist of square cells and there must be at least 10 grid intersects within each carbon estimation area that is sampled.

An anchor point for the grid must be established by either:

a. adopting an anchor point as determined by the requirements of a CFI methodology determination; or

b. randomly selecting an easting and northing within the ranges of easting and northing coordinates for the project area.

Note that a project may require more than one anchor point and grid to be established in order to achieve the minimum number of grid intersects for each carbon estimation area.

The easting and northing coordinates referred to above must be from the Map Grid of Australia, known as MGA94, or any Australian standard that replaces MGA94. The orientation of one axis of the grid must be along an azimuth determined by randomly selecting a whole number between zero and 89 degrees, where zero degrees is true north. Each grid intersect must be assigned a unique identifier.

Actual plot locations must be located within 10 metres of each intended plot location. This allows for reasonable variation associated with the translation of map coordinates to a physical location using a GPS system. The 10 metre allowance is not to be used for the subjective location of plots.

Plot shapes—general

Plots must have a fixed orthogonal area and a minimum size of 0.01ha and all plots in a carbon estimation area must have the same shape ***[Section 3.28]***.

In this section 'orthogonal area' means the area in a horizontal plane, not a sloping plane. Any measurements of length (e.g. the length of the side of a rectangular plot) must be the horizontal distance, not the slope distance.

Plot shapes—block plantings

If a carbon estimation area contains one or more block plantings, the plots must be either circular or rectangular ***[Section 3.29]***.

Circular plots

A circular plot must be established where the centre of the circular plot is centred at the actual plot location and the boundary of the circular plot is defined by the circumference.

Rectangular plots

A rectangular plot must be established so that the actual plot location has the same relative position in each rectangular plot in the carbon estimation area. That is, the plot is defined by starting at the same corner and applying the same orientation to each plot at the point of the actual plot location.

In this section 'relative position' means the most north-westerly, north-easterly, south-easterly or south-westerly corner of a rectangular plot.

Plot shapes—linear plantings

If the carbon estimation area contains a narrow or wide linear planting, the plots must be established in accordance with this section ***[Section 3.30]***.

The plots must have a rectangular shape and the centre line of the plot must:

a. be perpendicular to the row; and

b. pass through the actual plot location.

The centre line between the boundaries of the carbon estimation area must be used to measure the plot width.

The distance between the 2 ends of the plot must be determined by dividing the plot area (square metres) by the plot width (metres), and then establishing the 2 lines defining each end of the plot parallel to and equidistant from the centre line.

Plots extending beyond the carbon estimation area boundary

If a plot extends beyond the boundaries of a carbon estimation area, only trees and shrubs in the plot that are also within the carbon estimation area boundary are permitted to be counted ***[Section 3.31]***.

Note that for plots that extend beyond a carbon estimation area's (CEA) boundary, only trees and shrubs within the CEA are counted, but for calculation purposes the area of the plot is taken to be the same as for other plots in that CEA.

However, if the plot has already been established in accordance with an existing CFI methodology determination, the rules pertaining to the treatment of a plot crossing the boundary of a carbon estimation area or equivalent under that CFI methodology determination may be applied to the treatment of the plot.

Division 3.6 Calculating stocking density and tree proportion

Subdivision 3.6.1 Stocking density

Calculating stocking density of a plot

The stocking density of a plot must be calculated using Equation 1 ***[Section 3.32].***

Calculating average stocking density

The average stocking density of a carbon estimation area must be calculated using Equation 2 ***[Section 3.33].***

Calculating margin of error for stocking density

The margin of error for the stocking density of a carbon estimation area must be calculated using Equation 3 ***[Section 3.34].*** The standard deviation of the average stocking density for plots within the carbon estimation area must be calculated using the formula for sample standard deviation at Equation 3a.

Calculating probable limits of error for stocking density

The probable limits of error for the stocking density of a carbon estimation area must be calculated using Equation 4 ***[Section 3.35].***

Calculating conservative estimate of stocking density

The conservative estimate of stocking density of a carbon estimation area must be calculated using Equation 5 ***[Section 3.36].***

Subdivision 3.6.2 Tree proportion

Calculating tree proportion

The proportion of the planting consisting of trees in a plot in a carbon estimation area must be calculated using Equation 6 ***[Section 3.37].***

Calculating average tree proportion

The average proportion of trees in a plot in a carbon estimation area must be calculated using Equation 7 ***[Section 3.38].***

Calculating margin of error for tree proportion

The margin of error for the tree proportion in a carbon estimation area must be calculated using Equation 8 ***[Section 3.39].*** The standard deviation of the average tree proportion for plots within the carbon estimation area must be calculated using the formula for sample standard deviation at Equation 8a.

Calculating probable limits of error for tree proportion

The probable limits of error for tree proportion in a carbon estimation area must be calculated using Equation 9 ***[Section 3.40].***

Calculating conservative estimate of tree proportion

The conservative estimate of tree proportion in a carbon estimation area must be calculated using Equation 10 ***[Section 3.41].***

Division 3.7 Plantings—competition from adjacent trees

Competition from adjacent trees

A narrow or wide linear planting must not be subject to competition from adjacent trees in the adjoining area where the competition has a material impact on sequestration in the planting ***[Section 3.42].***

Competition from adjacent trees can impact significantly on the growth and sequestration achieved by a planting. Where material completion is present the use of a specific calibration for modelling is not permitted as this will result in an overestimation of abatement from the planting.

A project proponent must determine whether there is material competition from adjacent trees with narrow or wide linear planting in accordance with this Division.

Note that the presence or absence of adjacent trees may be demonstrated using remotely-sensed imagery dated no earlier than 3 years prior to the planting date for the planting.

Furthermore a proponent is able to re-stratify in accordance with section 3.8, to define a carbon estimation area such that it is not subject to material competition from adjacent trees. This means an area consisting of a narrow or wide linear planting could be re-stratified to apply a block planting calibration or generic calibration to those parts of that are affected by material competition and the appropriate specific calibration to parts that are not subject to material competition and also satisfy the other requirements.

In this Division:

- clumped adjacent trees means a group of adjacent trees where the stems are less than 20 metres apart.
- individual adjacent tree means an adjacent tree that is more than 20 metres from any other adjacent tree.

Note that adjacent trees are taken to impact across the entire width of a narrow linear planting due to the short distance across the planting strip. However, adjacent trees are only taken to impact one edge of a wide linear planting. Consequently the length of the long axis of the planting is doubled before calculating the impacted percentage of the planting. This means a wide linear planting can effectively have twice as many individual adjacent tree impacts before there is a material impact on sequestration.

Determining material competition —individual adjacent trees only

Subject to the requirements of competition from grouped adjacent trees in section 3.44, material competition from adjacent trees is taken to have occurred for narrow or wide linear plantings if, the following occurs ***[Section 3.43]***:

a. for a narrow linear planting—if on average, there is more than one individual adjacent tree for every 150 metres of the boundaries parallel to the long axis of the planting; or

b. for a wide linear planting—if on average, there is more than one individual adjacent tree for every 75 metres of the boundaries parallel to the long axis of the planting.

Determining material competition—grouped adjacent trees

Material competition from adjacent trees is taken to have occurred for a narrow or wide linear planting from grouped adjacent trees from a combination of ***[Section 3.44]***.

a. a single occurrence of grouped adjacent trees; or

b. multiple occurrences of grouped adjacent trees;

c. either (a) or (b) in combination with individual adjacent trees;

if more than 20% of the net length of the planting is subject to competition from adjacent trees (referred to as the net length of impact) as determined in accordance with the requirements in this section.

Note that if only individual adjacent trees are present in the adjoining area the project proponent must have determined if material completion has occurred in accordance with section 3.43.

The net length of impact of grouped adjacent trees is estimated in accordance with the following requirements:

Step 1: The distance between the outermost stems of the grouped adjacent trees must be measured along the long axis of the planting.

Step 2: The length of impact of each clump must be determined by adding 40 metres to the distance determined in Step 1.

Step 3: The length of impact of each occurrence of an individual adjacent tree is taken to be 40 metres.

Step 4: The gross length of impact of the adjacent trees is determined by adding together the distances specified in Steps 2 and 3.

Overlap adjustment for a narrow linear planting

An overlap adjustment is required to be made to the gross length of impact if the planting is a narrow linear planting where:

a. there are adjacent trees on opposite sides of a narrow linear planting; and

b. the length of impact of these adjacent trees overlaps;

If this is the case then:

c. the distance of the overlap along the long axis of the planting must be measured; and

d. the distance determined in (c) must be halved to give the overlap adjustment; and

e. the overlap adjustment calculated in (d) must be subtracted from the gross length of impact calculated in *Step 4* above.

The net length of impact must then be calculated as follows:

a. for a narrow linear planting—be the length determined in accordance with *Steps 1* to *4* and if relevant applying the *overlap adjustment for a narrow linear planting*; or

b. for a wide linear planting—be the length determined in accordance with *Steps 1* to *4*.

To determine if there are too many single or grouped trees in proximity to the planting the following test is applied:

If the net length of the adjacent tree impact is:

a. for a narrow linear planting— more than 20% of the length of the long axis of the planting; or

b. for a wide linear planting— more than 20% of twice the length of the long axis of the planting;

then the adjacent trees are taken to have a material impact on sequestration in the planting.

Division 3.8 Restricted activities

Harvesting

Subject to the conditions that follow, biomass must not be removed from a carbon estimation area ***[Section 3.45]***. Up to 10% of fallen timber may be removed from a carbon estimation area in a calendar year for personal use.

In this section 'personal use', of fallen timber, means use that does not involve the sale, or other commercial use, of the timber.

Other permitted removals

Biomass may be harvested ***[Section 3.46]***:

a. subject to section 3.48, for thinning for ecological purposes; or

b. to remove debris for fire management; or

c. to remove fruits, nuts, seeds, or material used for fencing or as craft materials, if those things are not removed for sale; or

d. in accordance with traditional indigenous practices or native title rights.

Grazing

If grazing occurs in a carbon estimation area the grazing must not affect the achievement or maintenance of forest cover in the area and the Regulator may request evidence that demonstrates, to the satisfaction of the Regulator, that the grazing has not ***[Section 3.47]***:

a. prevented the achievement or maintenance of forest cover; or

b. resulted in actual carbon stocks in the area failing to reach the level of modelled carbon stocks.

Thinning

If thinning occurs in a carbon estimation area a specific calibration cannot be used; and the generic calibration must be used for the purpose of modelling carbon stocks under Division 4.3. This is because the other calibrations cannot account for the effects of a thinning management event. Note that Section 4.8 specifies the primary requirements to be met for the use of a specific calibration ***[Section 3.48]***.

Use of lime or fertiliser

If the use of lime or fertiliser occurs in a carbon estimation area a specific calibration cannot be used and the generic calibration must be applied for the purpose of modelling carbon stocks under Division 4.3. This is because the other calibrations cannot account for the effects of a fertiliser application event. Note that Section 4.8 specifies the primary requirements to be met for the use of a specific calibration ***[Section 3.49]***.

Part 4 The net abatement amount

Division 4.1 The net abatement amount

The net abatement amount

In relation to a reporting period for a project under the Determination, the carbon dioxide equivalent net abatement amount is taken to be the change in carbon stock for the total number of carbon estimation areas within the project area when compared to the baseline, less the emissions of relevant greenhouse gases resulting from the project ***[Section 4.1]***.

Division 4.2 Calculations—Preliminary

Subdivision 4.2.1 General

General

In this Part if a calculation refers to a factor or parameter prescribed in the NGER Measurement Determination or the NGER Regulations, the person carrying out the calculations must apply, to the whole reporting period, that factor or parameter from the NGER Measurement Determination or NGER Regulations in force at the time that the offsets report is submitted or was required to be submitted, whichever is earlier ***[Section 4.2]***.

Greenhouse gas assessment boundary

When making calculations under this Part the carbon pools and emission sources and the corresponding greenhouse gases in Table 1 of the Determination must be taken into account and no other gases, carbon pools or emission sources may be taken into account ***[Section 4.3]***.

Table 1: Gases accounted for in the abatement calculations

Carbon pool	**Greenhouse gas**
Live above-ground biomass	Carbon dioxide (CO_2)
Live below-ground biomass	Carbon dioxide (CO_2)
Debris	Carbon dioxide (CO_2)
Emission source	**Greenhouse gas**
Fuel use	Methane (CH_4) Nitrous oxide (N_2O) Carbon dioxide (CO_2)
Fire—planned and unplanned	Methane (CH_4) Nitrous oxide (N_2O) Carbon dioxide (CO_2)

Baseline for a project

In relation to a reporting period, the baseline for a project is the carbon stock that the carbon estimation areas for the project would have had if the land use and management had continued as they were prior to the project being undertaken. Under this Determination, the baseline amount is taken to be zero and is not recalculated during the project ***[Section 4.4]***.

Subdivision 4.2.2 FullCAM modelling

FullCAM modelling

In accordance with the FullCAM Guidelines, FullCAM must be used to model the following parameters for each carbon estimation area ***[Section 4.5]***:

a. carbon stock;

b. emissions from disturbances; and

c. the effects of a management event.

FullCAM input data

For each carbon estimation area the following data must be collected for input to FullCAM ***[Section 4.6]***:

a. the model point location (latitude and longitude);

b. the last planting date;

c. the species;

d. where applicable, the stocking density of the project trees and/or shrubs in the reporting period;

e. where applicable, the tree proportion of the project trees in the reporting period;

f. domain group information to support the use of a particular FullCAM calibration;

g. management event data; and

h. disturbance event data.

FullCAM outputs

The output data from FullCAM specified in Table 2 of the Determination must be generated in accordance with the FullCAM Guidelines for the Determination. This output data must be used when calculating net abatement in accordance with this Part ***[Section 4.7]***.

Note that FullCAM outputs the parameters in units of either tonnes or kilograms per hectare, of carbon, methane or nitrous oxide. These are then converted to tonnes of CO2-e in the Equations in this Part. Biomass from the shrub component of a planting is accounted for in the FullCAM calibrations that have been used for modelling and incorporated in the FullCAM output.

Table 2: FullCAM output required for calculating abatement

FullCAM Output	Units	Description	Form	Parameter and Equation
Initial C mass of trees	tonnes C per hectare	Initial carbon stock in above-ground and below ground tree biomass	Time series - monthly (cumulative)	C_{Dti} Equation 12a
Initial C mass of forest debris	tonnes C per hectare	Initial carbon stock in debris	Time series - monthly (cumulative)	C_{Ddi} Equation 12a
C mass of trees	tonnes C per hectare	Carbon stock in above-ground and below ground tree biomass	Time series - monthly (cumulative)	C_{ti} Equation 12b
C mass of forest debris	tonnes C per hectare	Carbon stock in debris	Time series - monthly (cumulative)	C_{di} Equation 12b
CH_4 emitted due to fire	tonnes CH_4 per hectare	Mass of CH_4 emitted to the atmosphere due to fire	Time series monthly (non-cumulative)	$E_{CH_4 i}$ Equation 13
N_2O emitted due to fire	kg N_2O per hectare	Mass of N_2O emitted to the atmosphere due to fire	Time series – monthly (non-cumulative)	$E_{N_2 Oi}$ Equation 14

FullCAM modelling—requirements for calibrations

A calibration must be applied for each carbon estimation area in accordance with this section and the FullCAM Guidelines for the purpose of modelling using FullCAM under section 4.5 ***[Section 4.8]***.

Subject to section 4.9 which provides for particular exemptions, if a planting in a carbon estimation area does not satisfy the requirements to apply a specific calibration, the generic calibration must be applied for the carbon estimation area.

Requirements for the application of a specific calibration in FullCAM

Subject to section 4.9, a specific calibration may only be applied to a carbon estimation area

if the planting in the area satisfies the requirements of an applicable domain group specified in Schedule 1 as follows ***[Section 4.8]***:

a. planting type as defined in Division 3.3;

b. planting geometry and spacing as defined in Division 3.4; and

c. if applicable for the specific calibration, stocking density and tree proportion, as determined by Division 3.5.

In addition, there is a requirement that the test for material competition from adjacent trees demonstrated that adjacent tree competition had no material impact, as determined by Division 3.6.

FullCAM modelling—calibration requirement exemptions

Block calibration exemption

If a particular planting satisfies the domain group requirement for a planting type but fails any or all of the requirements for: planting geometry, planting spacing, or stocking density and/or tree proportion; or the test for material competition from adjacent trees (for a narrow or wide linear planting, then the specific calibration for the relevant block planting geometry for that planting type may be applied for the purpose of Division 4.3 ***[Section 4.9]***.

Note that this exemption allows for a planting type that fails to meet the conditions for certain specific calibrations to be modelled using the 'block planting-geometry' calibration for the planting type rather than having to use the generic calibration.

E.polybractea calibration exemption

A mallee planting of *E.polybractea* that meets the requirements of a narrow linear planting as specified in subsection 3.11(1) and the requirements of section 3.14; and is also not affected by material competition from adjacent trees as determined by Division 3.7, may apply the FullCAM 'Regime (Initial Rotation)' setting for the '*Mallee eucalypt polybractea, Geometry wide*' specific calibration for the purpose of modelling using FullCAM under section 4.5 ***[Section 4.9]***.

Note that stocking density and tree proportion are not relevant for the '*Mallee eucalypt polybractea*, *geometry wide*' specific calibration.

Division 4.3 Calculation of carbon stock change

Calculating initial carbon stock for project

The initial carbon stock for a project must be calculated in accordance with this section ***[Section 4.10]***.

The initial carbon stock for the first offsets report is for:

a. projects that commenced before the declaration date—the carbon stock for the project area at the declaration date;

b. all other projects—zero.

The initial carbon stock must be calculated for each reporting period using Equation 11a. This is necessary in order to deduct the pre-existing carbon stock in the project area that was present prior to the declaration of an eligible offsets project. This pre-existing carbon stock , though part of an eligible planting is not eligible to be credited as abatement achieved by the project. .

Calculating project area carbon stock at end of reporting period

The carbon stock for the project area is the sum of the carbon stock in each carbon estimation area and must be calculated at the end of each reporting period using Equation 11b ***[Section 4.11]***.

Calculating carbon stock for carbon estimation area

Calculating initial carbon stock for carbon estimation area

For each reporting period the initial carbon stock for a carbon estimation area is the sum of FullCAM outputs for initial carbon stocks in the tree and debris pools determined in accordance with Subdivision 4.2.2, and must be calculated using Equation 12a ***[Section 4.12]***.

Calculating carbon stock for carbon estimation area

For each reporting period the carbon stock for a carbon estimation area is the sum of FullCAM outputs for carbon in the tree and debris pools determined in accordance with Division 4.2, and must be calculated using Equation 12b ***[Section 4.12]***.

Division 4.4 Calculation of project emissions

Calculating emissions from biomass burning

For each reporting period the emissions of methane (CH_4) due to biomass burning in the reporting period must be calculated using Equation 13 ***[Section 4.13]***.

For each reporting period the emissions of nitrous oxide (N_2O) due to biomass burning in the reporting period must be calculated using Equation 14***[Section 4.13]***.

For each reporting period the total emissions due to biomass burning for the project in the reporting period, must be calculated using Equation 15 ***[Section 4.13]***.

Calculating emissions from fuel use

Emissions from fuel use must be calculated from the end of the previous reporting period to the last month of the current reporting period using Equations 16 and 17. The amount of fuel used can be determined either from raw data or estimates for quantities and types of fuel used ***[Section 4.14]***.

The fuel emissions for each fuel type and each greenhouse gas type (carbon dioxide, nitrous oxide and methane) for the reporting period must be calculated using Equation 16.

The energy content factor for a given fuel type and the emission factor for each of carbon dioxide, nitrous oxide and methane for a given fuel type are both prescribed in Schedule 1 of the NGER Measurement Determination.

Note that if the quantity of the fuel type is measured in gigajoules, then the energy content factor for the fuel type is equal to 1.

The relevant energy content and emission factors are also included, with worked examples, in the National Greenhouse Accounts Factors available via the Department's website.

The total emissions from fuel use for the reporting period must be calculated using Equation 17.

Division 4.5 Calculation of the carbon dioxide equivalent net abatement amount

Calculating the carbon dioxide equivalent net abatement amount for a project

The carbon dioxide equivalent net abatement amount for the offsets project must be calculated using Equation 18. ***[Section 4.15]***

The equation uses the previous carbon stock reported in the most recent offsets report accepted by the Regulator when calculating the net abatement amount for the current reporting period. A previous offsets report means the most recent report for the project submitted under this or any other applicable determination and for which a certificate of entitlement has been issued. For the definition of a certificate of entitlement, see section 15 of the Act.

Note that if the current reporting period is the first reporting period for the project then the previous carbon stock reported is taken to be zero.

Division 4.6 Data collection

Data collection—general

A project proponent must collect and record data on. ***[Section 4.16]***:

a. forest potential;

b. stratification of a carbon estimation area;

c. project monitoring;

d. if applicable, the timing and intensity of grazing; and

e. fuel use.

Note that a project proponent must retain records that can be used to estimate the quantity of fuel, recorded in kilolitres (kL), for each fuel type combusted when undertaking project activities within a reporting period.

FullCAM inputs

The following data relating to FullCAM inputs must be collected in accordance with Part 3 and the FullCAM Guidelines . ***[Section 4.17]***:

a. location data;

b. domain information to support the use of a given FullCAM calibration;

c. management event data; and

d. disturbance event data.

Part 5 Monitoring, record-keeping and reporting requirements

Division 5.1 General

Application

For subsection 106(3) of the Act, the project proponent of an eligible offsets project to which this Determination applies must comply with the monitoring, record keeping and reporting requirements of this Part. ***[Section 5.1]***.

Geospatial information requirements

The CFI Mapping Tool or a geographic information system that meets the requirements of the CFI Mapping Guidelines must be used to monitor and report on geospatial information in accordance with the CFI Mapping Guidelines ***[Section 5.2]***.

Division 5.2 Monitoring requirements

Project monitoring

A project proponent must monitor the project to ensure compliance with Part 3 and the CFI Mapping Guidelines; and collect information to demonstrate that the requirements for the use of a specific calibration have been met ***[Section 5.3]***.

Monitoring must also be undertaken to identify and record management and disturbance events within the project area.

A project proponent may use on-ground observation and/or remote-sensing or imagery to meet the monitoring requirements above and to collect information to assist in demonstrating that the requirements for the use of a specific calibration have been met.

Division 5.3 Record-keeping requirements

Records that must be kept

A project proponent must create and maintain the following records ***[Section 5.4]***:

a. evidence that there was no forest cover in the project area before project commencement;
b. a description of how each carbon estimation area was identified;
c. evidence to justify stratification within the project area, including any of the following:
    i. planting or management records;
    ii. soil, vegetation or landform maps;
    iii. monitoring records;
d. evidence of all plant species established within each carbon estimation area, including the stocking density and tree proportion at establishment;
e. date stamped FullCAM output files (.plo file) for each carbon estimation area modelled using FullCAM;
f. information regarding fires occurring in a carbon estimation area, including:
    i. the date the fire occurred;
    ii. the location of the fire;
    iii. the proportion of the carbon estimation area affected by the fire; and
    iv. the percentage of trees that were killed by the fire;

g. information regarding each Equation in Division 4.3, including:
    i. all input data;
    ii. the result; and
h. records relating to fuel use on project activities.

Note that records relating to fuel use on project activities could include invoices, vehicle logbooks, records of project activities, or reports of calculated consumption based on hourly or per hectare consumption rates.

If records of fuel use for project activities cannot be disaggregated from records for other non-project activities, estimates of project fuel use may be based on the time spent undertaking project activities and the known average fuel consumption of vehicles or machinery.

Forest management records

A project proponent must collect and maintain the following records of forest management for each carbon estimation area ***[Section 5.5]***:

a. evidence of forest potential, including:
    i. estimated stocking density; and
    ii. anticipated crown cover at maturity;
b. once forest cover is achieved:
    i. the year when forest cover was achieved; and
    ii. evidence that forest cover is maintained;

and;

c. the modelling commencement date;

A project proponent must collect and maintain the following records of forest management in relation to FullCAM inputs for each carbon estimation area, including:

a. the type and timing of management events, including:
    i. planting;
    ii. weed control;
    iii. fertiliser application;
b. the type, timing and extent of disturbance events;
c. a description of any management actions or disturbance events that affected a carbon estimation area during the reporting period, including if applicable, actions proposed and undertaken to ensure that carbon stocks are restored; and
d. if applicable, evidence demonstrating that grazing has not prevented the requirements in section 3.47 being met.

Specific calibration records

If a specific calibration is applied for FullCAM modelling of a carbon estimation area, a project proponent must create and maintain records that include ***[Section 5.6]***:

a. planting type;
b. planting geometry;
c. planting spacing;

d. if applicable, evidence of stocking density and tree proportion;

e. if applicable, evidence that the assessment of adjacent trees as specified in Division 3.7 has been completed and the result for each carbon estimation area.

If sampling is used to estimate stocking densities and tree proportions, the following records must be created and maintained:

a. a map of the intended and actual plot locations;

b. the grid orientation and anchor coordinates;

c. a description of plot area and dimensions;

d. if used, a copy of remotely-sensed imagery;

e. the number of plots in each carbon estimation area;

f. the estimated values of stocking density and tree proportion for each carbon estimation area;

g. the probable limits of error for stocking density and tree proportions for each carbon estimation area; and

h. the stocking density and tree proportion.

Project area records

A project proponent must create and maintain the following records for the project area ***[Section 5.7]***:

a. geospatial maps that identify:

   i. the project area;

   ii. carbon estimation areas;

   iii. exclusion areas; and

   iv. model points for each carbon estimation area;

b. if the attributes specified above are not clearly visible on the maps, a list of names or other identifiers that identify the project area and each carbon estimation area; and

c. any adjustments to a carbon estimation area if:

   i. the carbon estimation area no longer meets the requirements set out in Division 3.2; or

   ii. changes in the management of the carbon estimation area result in re-stratification.

Division 5.4 Offsets report requirements

Information in first offsets report

The following information must be included in the first offsets report for a project to which this Determination applies ***[Section 5.8]***:

a. carbon dioxide equivalent net abatement amount for the project;

b. carbon stock change for the first reporting period for the project;

c. total emissions due to biomass burning for the project;

d. total fuel emissions due to project activities;

e. initial carbon stock for the first reporting period;

f. if the planting date occurred before the declaration date—the initial carbon stock at the declaration date;

g. carbon stock for the project at the end of the reporting period;

h. forest management information set out in section 5.5;

i. if relevant, specific calibration information set out in section 5.6;

j. project area information set out in subsections 5.7(a) to (b);

k. date-stamped FullCAM plot files (.plo) and a copy of the associated output data in a spread sheet file for each carbon estimation area in the project area; and

l. if forest cover is attained during the first reporting period—evidence that the cover has been attained. Note that evidence may include date-stamped, geo-referenced satellite imagery.

Note that if the project proponent has previously submitted an offsets report for the project under another CFI methodology determination, then the first offsets report for the project has taken to have been submitted under that other CFI methodology determination.

Information in subsequent offsets reports

The following information must be included in the second and subsequent offsets reports for a project to which this Determination applies ***[Section 5.9]***:

a. carbon dioxide equivalent net abatement amount for the project for the reporting period;

b. carbon stock change for the project for the reporting period;

c. total emissions due to biomass burning for the project;

d. total fuel emissions due to project activities;

e. carbon stock for the project at the end of the reporting period;

f. forest management information set out in section 5.5 and, if relevant, section 5.6, including any change to this information provided in the previous reporting period;

g. date-stamped FullCAM plot files (.plo) and a copy of the associated output data in a spread-sheet file for each carbon estimation area in the project area;

h. if forest cover is attained in the reporting period, evidence that forest cover has been attained. Note that evidence may include date-stamped, geo-referenced remotely-sensed imagery.

i. if forest cover was attained in a previous reporting period, evidence that forest cover has been maintained. Note that evidence may include date-stamped, geo-referenced remotely-sensed imagery.

j. either:

    i. a statement that the carbon estimation area boundaries have not been changed; or

    ii. details of any change to carbon estimation area or exclusion areas compared to information provided in the previous reporting period.

Schedule 1 Specific calibrations for use in FullCAM.

Calibration type	Planting Type (FullCAM Tree species)	Planting geometry	Stocking density and tree proportion	Specific Calibration [FullCAM Regimes (Initial Rotation)]
Specific	Mixed species environmental planting temperate	Narrow Linear	Stocking > 1500 stems/ha and Tree Proportion >= 0.75	Mixed species temperate, Geometry narrow, Stocking >1,500, Prop tree >=0.75
			Tree Proportion >= 0.75	Mixed species temperate, Geometry narrow, Stocking <1,500, Prop tree >=0.75
			Stocking > 1500 stems/ha	Mixed species temperate, Geometry narrow, Stocking >1,500, Prop tree <0.75
			No sampling required	Mixed species temperate, Geometry narrow, Stocking <1,500, Prop tree <0.75
		Wide linear	Stocking > 1500 stems/ha and Tree Proportion >= 0.75	Mixed species temperate, Geometry wide, Stocking >1,500, Prop tree >=0.75
			Stocking > 1500 stems/ha	Mixed species temperate, Geometry wide, Stocking >1,500, Prop tree <0.75
			Tree Proportion >= 0.75	Mixed species temperate, Geometry wide, Stocking <1,500, Prop tree >=0.75
			No sampling required	Mixed species temperate, Geometry wide, Stocking <1,500, Prop tree <0.75
		Block	Stocking 500 - 1500 stems/ha and Tree Proportion >= 0.75	Mixed species temperate, Geometry block, Stocking 500 - 1,500, Prop tree >=0.75
			Stocking > 1500 stems/ha	Mixed species temperate, Geometry block, Stocking >1,500
			Stocking 500 - 1500 stems/ha	Mixed species temperate, Geometry block, Stocking 500 - 1,500, Prop tree <0.75
			Tree Proportion >= 0.75	Mixed species temperate, Geometry block, Stocking <500, Prop tree >=0.75
			No sampling required	Mixed species temperate, Geometry block, Stocking <500, Prop tree <0.75
Specific	Mixed species environmental planting tropical	Block	No sampling required	Mixed species tropical, Geometry block
Generic	Mixed species environmental planting	n/a	No sampling required	Mixed species environmental planting (1970-present All Plantation low: Non-commercial planting; No prunes)
		n/a	No sampling required	Mixed species environmental planting (1970-present All Plantation high: Non-commercial planting; No prunes)
		n/a	No sampling	Mixed species environmental planting (1970-present All Plantation medium: Non-commercial planting; No

Calibration type	Planting Type (FullCAM Tree species)	Planting geometry	Stocking density and tree proportion	Specific Calibration [FullCAM Regimes (Initial Rotation)]
			required	prunes)
Specific	Mallee eucalypt kochii	Block	No sampling required	Mallee eucalypt kochii, Geometry block
		Wide linear	No sampling required	Mallee eucalypt kochii, Geometry wide
		Narrow linear	Stocking > 2,300 stems/ha	Mallee eucalypt kochii, Geometry narrow, Stocking >2,300
			No sampling required	Mallee eucalypt kochii, Geometry narrow, Stocking <2,300
Specific	Mallee eucalypt loxophleba lissophloia	Block	No sampling required	Mallee eucalypt loxophleba lissophloia, Geometry block
		Wide Linear	No sampling required	Mallee eucalypt loxophleba lissophloia, Geometry wide
		Narrow linear	Stocking > 2,300 stems/ha	Mallee eucalypt loxophleba lissophloia, Geometry narrow, Stocking >2,300
			No sampling required	Mallee eucalypt loxophleba lissophloia, Geometry narrow, Stocking <2,300
Specific	Mallee eucalypt polybractea	Block	No sampling required	Mallee eucalypt polybractea, Geometry block
		Wide linear	No sampling required	Mallee eucalypt polybractea, Geometry wide

Schedule 2 Planting geometry requirements for belt plantings planted in rows

Planting Type	Planting geometry	Number of rows in a belt planting (R)[1]	Maximum permitted row width for a belt planting (M)[1] (metres)	Maximum permitted width for a belt planting (A)[1] (metres)
Mallee Planting (planted in rows)	Narrow Linear	2	4	4
	Wide Linear	3	3	6
		4	2.67	8
		5	2.5	10
		6	2.4	12
		7	2.33	14
		8	2.29	16
	Block	More than 8 rows or other geometry that is not consistent with a linear planting	4	Width of planting+ 2 metres
Environmental Planting (planted in rows)	Narrow Linear	Not Applicable— Planting can be up to 20 metres wide	Not Applicable [2]	Width of planting+2 metres up to a maximum of 22 metres
	Wide Linear	Not Applicable— Planting can be between 20 metres and 40 metres wide	Not Applicable [2]	Width of planting+2 metres up to a maximum of 42 metres
	Block	Not Applicable— Planting is more than 40 metres wide	Not Applicable [2]	Width of planting+ 2 metres

Notes:

1: Maximum permitted row width for a belt planting (M) is determined using the following equation: M = A/(R-1); where A is the maximum permitted carbon estimation area width and R is the number of rows in an individual belt. If any linear plantings are planted at the maximum allowable row width, then the boundary of the carbon estimation area along the long axis will equal the stem line of the outer rows.

2: Effective maximum row width in a belt is less than 5 metres in order to be consistent with the CFI Mapping Guidelines with respect to exclusion areas.

Attachment B

Statement of Compatibility with Human Rights

Prepared in accordance with Part 3 of the *Human Rights (Parliamentary Scrutiny) Act 2011*

Carbon Credits (Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings—FullCAM) Methodology Determination 2014. This legislative instrument is compatible with the human rights and freedoms recognised or declared in the international instruments listed in section 3 of the *Human Rights (Parliamentary Scrutiny) Act 2011*.

Overview of the Legislative Instrument

The *Carbon Credits (Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings—FullCAM) Methodology Determination 2014* (the Determination) sets out detailed rules for implementing and monitoring projects under the Carbon Farming Initiative to sequester carbon by establishing and maintaining trees that have the potential to attain a height of at least 2 metres, and a crown cover of at least 20%, on land that has previously been used for agricultural purposes in any part of Australia.

The Determination provides for the calculation of the net project abatement of greenhouse gases during a reporting period by using FullCAM to model the carbon stored in the biomass of project trees, litter and fallen dead wood, known as 'project forest biomass'. The carbon dioxide removed from the atmosphere and stored as carbon within project forest biomass at the time the project commences, and emissions of carbon dioxide, methane or nitrous oxide from fossil fuel use and fire events during the reporting period, are then used to calculate project abatement.

Project proponents wishing to implement the Determination must make an application to the Clean Energy Regulator (Regulator) and meet the eligibility requirements set out under the *Carbon Credits (Carbon Farming Initiative) Act 2011*. Offsets projects that are approved by the Regulator can generate Australian carbon credit units.

Human rights implications

This legislative instrument does not engage any of the applicable rights or freedoms.

Conclusion

This legislative instrument is compatible with human rights as it does not raise any human rights issues.